Floods

Floods are one of the most common hazards in the U.S. However, all floods are not alike. Some floods develop slowly, sometimes over a period of days; however, flash floods can dvelop quickly, sometimes in just a few minutes, and without any visible signs of rain. Flash floods often have a dangerous wall of roaring water that carries a deadly cargo of rocks, mud and other debris and can sweep away most things in its path. Overland flooding occurs outside a defined river or stream, such as when a levee is breached, but still can be destructive. Flooding can also occur from a dam breaks, producing effects similar to flash floods.

Go to higher ground during floods. Moving water only 6 inches deep can knock you off your feet.

Flood effects can be very local, impacting a neighborhood or community, or very large, effecting entire river basins and multiple states.

Be aware of flood hazards no matter where you live, but especially if you live in a low-lying area, near water or downstream from a dam. Even very small streams, gullies, creeks, culverts, dry streambeds or low-lying ground that appear harmless in dry weather can flood. Every state is at risk from this hazard.

What to do before a flood

1. Know the terms used to describe flooding:
   - **Flood Watch**—Flooding is possible. Stay tuned to NOAA Weather Radio or commercial radio or television for information. Watches are issued 12 to 36 hours in advance of a possible flooding event.
   - **Flash Flood Watch**—Flash flooding is possible. Be prepared to move to higher ground. A flash flood could occur without any warning. Listen to NOAA Weather Radio or commercial radio or television for additional information.
   - **Flood Warning**—Flooding is occurring or will occur soon. If advised to evacuate, do so immediately.
   - **Flash Flood Warning**—A flash flood is occurring. Seek higher ground on foot immediately.
2. Ask local officials whether your property is in a flood-prone or high-risk area. (Remember that floods often occur outside high-risk areas.) Ask about official flood warning signals and what to do when you hear them. Also ask how you can protect your home from flooding.
3. Identify dams in your area and determine whether they pose a hazard to you.

4. Purchase a NOAA Weather Radio with battery backup and a tone-alert feature that automatically alerts you when a **Watch** or **Warning** is issued (tone alert not available in some areas). Purchase a battery-powered commercial radio and extra batteries.

5. Be prepared to evacuate. Learn your community's flood evacuation routes and where to find high ground. See the "Evacuation" chapter for important information.

6. Talk to your household about flooding. Plan for a place to meet your household in case you are separated from one another and cannot return home. Choose an out-of-town contact for everyone to call to say they are safe. In some emergencies, calling out-of-state is possible even when local phone lines are down.

Keep supplies on hand for an emergency. Remember a battery operated NOAA Weather Radio with a tone-alert feature and extra batteries.

7. Determine how you would care for household members who may live elsewhere but might need your help in a flood. Determine any special needs your neighbors might have.

8. Prepare to survive on your own for at least three days. Assemble a disaster supplies kit. Keep a stock of food and extra drinking water. See the "Emergency Planning and Disaster Supplies" chapter for more information.

9. Know how to shut off electricity, gas and water at main switches and valves. Know where gas pilot lights are located and how the heating system works. Do not actually shut off the gas to see how it works or to show others. Only the gas comapny can safely turn it back on.

10. Consider purchasing flood insurance.

- Flood losses are *not covered* under homeowners' insurance policies.
- FEMA manages the National Flood Insurance Program, which makes federally-backed flood insurance available in communities that agree to adopt and enforce floodplain management ordinances to reduce future flood damage.
- Flood insurance is available in most communities through insurance agents.
- There is a 30-day waiting period before flood insurance goes into effect, so don't delay.
- You can buy flood insurance even if your building is outside of the main flood risk zone.

11. Consider options for protecting your property.

- Make a record of your personal property. Take photographs or videotapes of the exterior and interior of your home, including personal belongings. Store these documents in a safe place.
- Keep insurance policies, deeds, property records and other important papers in a safe place, such as a safe deposit box, away from your home.
- Avoid building in a floodplain unless you elevate and reinforce your home.
- Elevate furnace, water heater, and electric panel to higher floors or the attic if they are susceptible to flooding.
- Install "check valves" in sewer traps to prevent flood water from backing up into the drains of your home.
- Construct barriers such as levees, berms, and floodwalls to stop floodwater from entering the building.

- Seal walls in basements with waterproofing compounds to avoid seepage.
- Call your local building department or emergency management office for more information.

What to do during a flood

1. Be aware of flash flooding. If there is *any* possibility of a flash flood, move immediately to higher ground. Do not wait for instructions to move.
2. Listen to radio or television stations for local information.
3. Be aware of streams, drainage channels, canyons and other areas known to flood suddenly. Flash floods can occur in these areas with or without such typical warning signs as rain clouds or heavy rain.
4. If local authorities issue a flood watch, prepare to evacuate:
   - Secure your home. *If you have time*, tie down or bring outdoor equipment and lawn furniture inside. Move essential items to the upper floors.
   - If instructed, turn off utilities at the main switches or valves. Disconnect electrical appliances. *Do not touch* electrical equipment if you are wet or standing in water.
   - Fill the bathtub with water in case water becomes contaminated or services cut off. Before filling the tub, sterilize it with a diluted bleach solution (one part bleach to 10 parts water).
5. Do not walk through moving water. Six inches of moving water can knock you off your feet. If you must walk in a flooded area, walk where the water is not moving. Use a stick or pole to check the firmness of the ground in front of you.

If there is any possibility of a flash flood, move immediately to higher ground. Do not wait for instructions to move.

6. Do not drive into flooded areas. Six inches of water will reach the bottom of most passenger cars causing loss of control and possible stalling. A foot of water will float many vehicles. Two feet of water can carry away most vehicles, including sport utility vehicles (SUV's) and pickups.
7. If floodwaters rise around your car, abandon the car and move to higher ground, if you can do so safely. You and your vehicle can be quickly swept away as floodwaters rise.
8. See the “Evacuation” chapter for important information.

What to do after a flood

1. Avoid floodwaters. The water may be contaminated by oil, gasoline or raw sewage. The water may also be electrically charged from underground or downed power lines.
2. Avoid moving water. Moving water only six inches deep can sweep you off your feet.
3. Be aware of areas where floodwaters have receded. Roads may have weakened and could collapse under the weight of a car.
4. Stay away from downed power lines and report them to the power company.
5. Stay away from designated disaster areas unless authorities ask for volunteers.
6. Return home only when authorities indicate it is safe. Stay out of buildings if surrounded by floodwaters. Use extreme caution when entering buildings. There may be hidden damage, particularly in foundations.
7. Consider your family's health and safety needs:
   - Wash hands with soap and clean water if you come in contact with floodwaters.
   - Throw away food that has come in contact with floodwaters.
   - Listen for news reports to learn whether the community's water supply is safe to drink.
   - Listen to news reports for information about where to get assistance for housing, clothing and food.
   - Seek necessary medical care at the nearest open medical facility.
8. Service damaged septic tanks, cesspools, pits, and leaching systems as soon as possible. Damaged sewage systems are serious health hazards.

There is a 30-day waiting period before flood insurance goes into effect, so don't delay.

9. Contact your insurance agent. If your policy covers your claim, an adjuster will be assigned to visit your home. To prepare:
   - Take photos or videotapes of your damaged property.
   - Separate damaged and undamaged belongings.
   - Locate your financial records.
   - Keep detailed records of cleanup costs.
10. If your residence has been flooded, obtain a copy of *Repairing Your Flooded Home* from the American Red Cross. To mitigate future flood damage, obtain FEMA's *Homeowner's Guide to Retrofitting: Six Ways to Protect Your House from Flooding.* See the "For More Information" chapter for how to order this and other publications.
11. See the "Recovering From Disaster" chapter for more information.

Hurricanes

A hurricane is a type of tropical cyclone, the generic term for a low pressure system that generally forms in the tropics. The ingredients for a hurricane include a pre-existing weather disturbance, warm tropical oceans, moisture, and relatively light winds aloft. A typical cyclone is accompanied by thunderstorms, and in the Northern Hemisphere, a counterclockwise circulation of winds near the earth's surface.

All Atlantic and Gulf of Mexico coastal areas are subject to hurricanes or tropical storms. Although rarely struck by hurricanes, parts of the Southwest United States and the Pacific Coast experience heavy rains and floods each year from hurricanes spawned off Mexico. The Atlantic hurricane season lasts from June to November with the peak season from mid-August to late October.

Hurricanes can cause catastrophic damage to coastlines and several hundred miles inland. Winds can exceed 155 miles-per-hour. Hurricanes and tropical storms can also spawn tornadoes and microbursts, create surge along the coast, and cause extensive damage due to inland flooding from trapped water.

Tornadoes most often occur in thunderstorms embedded in rain bands well away from the center of the hurricane; however, they also occur near the eye-wall. Typically, tornadoes produced by tropical cyclones are relatively weak and short-lived but still pose a threat.

A storm surge is a huge dome of water pushed on-shore by hurricane and tropical storm winds. Storm surges can reach 25 feet high and be 50-100 miles wide. Storm tide is a combination of the storm surge and the normal tide (i.e., a 15 foot storm surge combined with a 2 foot normal high tide over the mean sea level creates a 17 foot storm tide). These phenomena cause severe erosion and extensive damage to coastal areas.

Despite improved warnings and a decrease in the loss of life, property damage continues to rise because an increasing number of people are living or vacationing near coastlines. Those in hurricane-prone areas need to be prepared for hurricanes and tropical storms.

Hurricanes are classified into five categories based on their wind speed, central pressure and damage potential (see chart on p.34). Category Three and higher are considered major hurricanes, though Category One and Two are still extremely dangerous and warrant your full attention.

Inland/freshwater flooding from hurricanes

Hurricanes can produce widespread torrential rains. Floods are the deadly and destructive result. Excessive rain can also trigger landslides or mud slides, especially in mountainous regions. Flash flooding can occur due to the intense rainfall. Flooding on rivers and streams may persist for several days or more after the storm.

The speed of the storm and the geography beneath the storm are the primary factors regarding the amount of rain produced. Slow moving storms and tropical storms moving into mountainous regions tend to produce more rain.

Between 1970 and 1999, more people lost their lives from freshwater flooding associated with landfalling tropical cyclones than from any other weather hazard related to tropical cyclones.

See the "Floods" chapter for more specific information on flood related emergencies.

What to do before a hurricane

1. Learn the terns used by weather forecasters:

   Tropical Depression. An organized system of clouds and thunderstorms with a defined surface circulation and maximum sustained winds of 38 mph (33 knots) or less. Sustained winds are defined as one-minute average wind measured at about 33 ft (10 meters) above the surface.

   Tropical Storm. An organized system of strong thunderstorms with a defined surface circulation and maximum sustained winds of 39-73 mph (34-63 knots).

   Hurricane. An intense tropical weather system of strong thunderstorms with a well-defined surface circulation and maximum sustained winds of 74 mph (64 knots) or higher.

   Storm Surge. A dome of water pushed on shore by hurricane and tropical storm winds.

   Storm Tide. A combination of storm surge and the normal tide (e.g., a 15-foot storm surge combined with a 2-foot normal tide over the mean sea level creates a 17-foot storm tide.)

2. Know the difference between "Watches" and "Warnings."
   - **Hurricane/Tropical Storm Watch—** Hurricane/tropical storm conditions are possible in the specified area, usually within 36 hours.

Saffir-Simpson Hurricane Scale

Scale Number (Category)	Sustained Winds (MPH)	Damage	Storm Surge
1	74-95	**Minimal:** Unanchored mobile homes, vegetation and signs.	4-5 feet
2	96-110	**Moderate:** All mobile homes, roofs, small crafts, flooding.	6-8 feet
3	111-130	**Extensive:** Small buildings, low-lying roads cut off.	9-12 feet
4	131-155	**Extreme:** Roofs destroyed, trees down, roads cut off, mobile homes destroyed. Beach homes flooded.	13-18 feet
5	>155	**Catastrophic:** Most buildings destroyed. Vegetation destroyed. Major roads cut off. Homes flooded.	>18 feet

- **Hurricane/Tropical Storm Warning**—Hurricane/tropical storm conditions are expected in the specified area, usually within 24 hours.
- **Short Term Watches and Warnings**—These warnings provide detailed information on specific hurricane threats, such as flash floods and tornadoes.

3. Listen for local radio or television weather forecasts. Purchase a NOAA Weather Radio with battery backup and a tone-alert feature that automatically alerts you when a Watch or Warning is issued (tone alert is not available in some areas). Purchase a battery-powered commercial radio and extra batteries as well because information on other events will be broadcast by the media.

4. Ask your local emergency management office about community evacuation plans relating to your neighborhood. Learn evacuation routes. Determine where you would go and how you would get there if you needed to evacuate. Sometimes alternate routes are desirable.

5. Talk to your household about hurricane issues. Create a household disaster plan. Plan to meet at a place away from your residence in case you are separated. Choose an out-of-town contact for everyone to call to say they are safe.

6. Determine the needs of your household members who may live elsewhere but need your help in a hurricane. Consider the special needs of neighbors, such as people that are disabled or those with limited sight or vision problems.

Create a household disaster plan. Plan to meet your family in case you are separated. Choose an out-of-town contact for everyone to call to say they are safe.

7. Prepare to survive on your own for at least three days. Assemble a disaster supplies kit. Keep a stock of food and extra drinking water. See the "Emergency Planning and Disaster Supplies" and "Evacuation" chapters for more information.

8. Make plans to secure your property. Permanent storm shutters offer the best protection for windows. A second option is to board up windows with 5/8" marine plywood, cut to fit and ready to install. Tape does not prevent windows from breaking.

9. Learn how to shut off utilities and where gas and water shutoffs are located. Do not actually shut off the gas to see how it works or to show others. Only the gas comapny can safely turn it back on.

10. Have your home inspected for compliance with local building codes. Many of the roofs destroyed by hurricanes were not constructed or retrofitted according to building codes. Installing straps or additional clips to securely fasten your roof to the frame structure will substantially reduce roof damage.

11. Be sure trees and shrubs around your home are well trimmed. Dead limbs or trees could cause personal injury or property damage. Clear loose and clogged rain gutters and downspouts.

12. If you have a boat, determine where to secure it in an emergency.

13. Consider flood insurance. Purchase insurance well in advance—there is a 30-day waiting period before flood insurance takes effect.

14. Make a record of your personal property. Take photographs or videotapes of the exterior and interior of your home,

including personal belongings. Store these documents in a safe place, such as a safe deposit box.

What to do during a hurricane threat

1. Listen to radio or television newscasts. If a hurricane "Watch" is issued, you typically have 24 to 36 hours before the hurricane hits land.
2. Talk with household members. Make sure everyone knows where to meet and who to call, in case you are separated. Consider the needs of relatives and neighbors with special needs.
3. Secure your home. Close storm shutters. Secure outdoor objects or bring them indoors. Moor your boat if time permits.
4. Gather several days' supply of water and food for each household member. Water systems may become contaminated or damaged. After sterilizing the bathtub and other containers with a diluted bleach solution of one part bleach to ten parts water, fill them with water to ensure a safe supply in case you are unable or told not to evacuate. Refer to the "Shelter and Emergency Planning" and "Disaster Supplies" chapters for important information.
5. If you are evacuating, take your disaster supplies kit with you to the shelter. Remember that alcoholic beverages and weapons are prohibited within shelters. Also, pets are not allowed in a public shelter due to health reasons. See the "Animals in Disaster" chapter and contact your local humane society for additional information.

Alcoholic beverages and weapons are prohibited within shelters. Also, pets are not allowed in public shelters for health reasons.

6. Prepare to evacuate. Fuel your car—service stations may be closed after the storm. If you do not have a car, make arrangements for transportation with a friend or relative. Review evacuation routes. If instructed, turn off utilities at the main valves or switches.
7. Evacuate to an inland location, if:
   - Local authorities announce an evacuation and you live in an evacuation zone.
   - You live in a mobile home or temporary structure—they are particularly hazardous during hurricanes no matter how well fastened to the ground.
   - You live in a high-rise. Hurricane winds are stronger at higher elevations.
   - You live on the coast, on a floodplain near a river or inland waterway.
   - You feel you are in danger.
8. When authorities order an evacuation:
   - Leave immediately.
   - Follow evacuation routes announced by local officials.
   - Stay away from coastal areas, riverbanks and streams.
   - Tell others where you are going.
9. If you are not required or are unable to evacuate, stay indoors during the hurricane and away from windows and glass doors. Keep curtains and blinds closed. Do not be fooled if there is a lull, it could be the eye of the storm—winds will pick up again.
   - If not instructed to turn off, turn the refrigerator to its coldest setting and keep closed.
   - Turn off propane tanks.

10. In strong winds, follow these rules:
    - Take refuge in a small interior room, closet or hallway.
    - Close all interior doors. Secure and brace external doors.
    - In a two-story residence, go to an interior first-floor room, such as a bathroom or closet.
    - In a multiple-story building, go to the first or second floors and stay in interior rooms away from windows.
    - Lie on the floor under a table or another sturdy object.
11. Avoid using the phone except for serious emergencies. Local authorities need first priority on telephone lines.
12. See the "Evacuation" chapter for important information.

What to do after a hurricane

1. Stay where you are if you are in a safe location until local authorities say it is safe to leave. If you evacuated the community, do not return to the area until authorities say it is safe to return.
2. Keep tuned to local radio or television stations for information about caring for your household, where to find medical help, how to apply for financial assistance, etc.
3. Drive only when necessary. Streets will be filled with debris. Roads will have weakened and could collapse. Do not drive on flooded or barricaded roads or bridges. Roads are closed for your protection. As little as six inches of water may cause you to lose control of your vehicle—two feet of water will carry most cars away.
4. Do not drink or prepare food with tap water until notified by officials that it is safe to do so.
5. Consider your family's health and safety needs. Be aware of symptoms of stress and fatigue. Keep your household together and seek crisis counseling if you have need. See the "Mental Health and Crisis Counseling" section of the "Recovering from Disaster" chapter for more information.

Consider your household's health and safety needs and be aware of symptoms of stress and fatigue. Seek crisis counseling if you have need.

6. Talk with your children about what has happened and how they can help during the recovery. Being involved will help them deal with the situation. Consider the needs of your neighbors. People often become isolated during hurricanes.
7. Stay away from disaster areas unless local authorities request volunteers. If you are needed, bring your own drinking water, food and sleeping gear.
8. Stay away from riverbanks and streams until potential flooding has passed. Do not allow children to play in flooded areas. There is a high risk of injury or drowning in areas that may appear safe.
9. Stay away from moving water. Moving water only six inches deep can sweep you off your feet. Standing water may be electrically charged from underground or downed power lines.
10. Stay away from downed power lines and report them to the power company. Report broken gas, sewer or water mains to local officials.

11. Don't use candles or other open flames indoors. Use a flashlight to inspect damage.
12. Set up a manageable schedule to repair property.
13. Contact your insurance agent. An adjuster will be assigned to visit your home. To prepare:
    - Take photos or videotapes of your damaged property.
    - Separate damaged and undamaged belongings.
    - Locate your financial records.
    - Keep detailed records of cleanup costs.
14. Consider building a "Safe Room or Shelter" to protect your household. See the "Thunderstorms" chapter for additional information in the "Tornadoes" section.
15. See the "Recovering From Disaster" chapter for more important information.

Thunderstorms

Thunderstorms are very common and affect great numbers of people each year. Despite their small size in comparison to hurricanes and winter storms, all thunderstorms are dangerous. Every thunderstorm produces lightning. Other associated dangers of thunderstorms include tornadoes, strong winds, hail, and flash flooding. Flash flooding is responsible for more fatalities— more than 140 annually— than any other thunderstorm-associated hazard.

When thunderstorms threaten your area, get inside a home, building or hard top automobile and stay away from metallic objects and fixtures.

Some thunderstorms do not produce rain that reaches the ground. These are generically referred to as dry thunderstorms and are most prevalent in the western United States. Known to spawn wildfires, these storms occur when there is a large layer of dry air between the base of the cloud and the ground. The falling raindrops evaporate, but lightning can still reach the ground.

What to do before thunderstorms approach

1. Know the terms used by weather forecasters:
   - **Severe Thunderstorm Watch**— Tells you when and where severe thunderstorms are likely to occur. Watch the sky and stay tuned to radio or television to know when warnings are issued.
   - **Severe Thunderstorm Warning**— Issued when severe weather has been reported by spotters or indicated by radar. Warnings indicate imminent danger to life and property to those in the path of the storm.
2. Know thunderstorm facts:
   - Thunderstorms may occur singly, in clusters, or in lines.
   - Some of the most severe weather occurs when a single thunderstorm affects one location for an extended time.
   - Thunderstorms typically produce heavy rain for a brief period, anywhere from 30 minutes to an hour.
   - Warm, humid conditions are very favorable for thunderstorm development.
   - A typical thunderstorm is 15 miles in diameter and lasts an average of 30 minutes.
   - Of the estimated 100,000 thunderstorms each year in the United States, about 10 percent are classified as severe.
   - A thunderstorm is classified as severe if it produces hail at least three-quarters of an inch in diameter, has winds of 58 miles per hour or higher, or produces a tornado.

3. Know the calculation to determine how close you are to a thunderstorm:
   - Count the number of seconds between a flash of lightning and the next clap of thunder. Divide this number by 5 to determine the distance to the lightning in miles.
4. Remove dead or rotting trees and branches that could fall and cause injury or damage during a severe thunderstorm.
5. When a thunderstorm approaches, secure outdoor objects that could blow away or cause damage. Shutter windows, if possible, and secure outside doors. If shutters are not available, close window blinds, shades, or curtains.

If a Tornado Warning is issued, take shelter immediately.

Lightning

The ingredient that defines a thunderstorm is lightning. Since lightning creates thunder, a storm producing lightning is called a thunderstorm.

Lightning occurs during all thunderstorms. Lightning results from the buildup and discharge of electrical energy between positively and negatively charged areas.

The unpredictability of lightning increases the risk to individuals and property. In the United States, an average of 300 people are injured and 80 people are killed each year by lightning. Although most lightning victims survive, people struck by lightning often report a variety of long-term, debilitating symptoms, including memory loss, attention deficits, sleep disorders, numbness, dizziness, stiffness in joints, irritability, fatigue, weakness, muscle spasms, depression, and an inability to sit for a long period of time.

When thunderstorms threaten your area, get inside a home, building or hard top automobile (not a convertible) and stay away from metallic objects and fixtures.

1. If you are **inside** a home:
   - Avoid showering or bathing. Plumbing and bathroom fixtures can conduct electricity.
   - Avoid using a corded telephone, except for emergencies. Cordless and cellular telephones are safe to use.
   - Unplug appliances and other electrical items such as computers and turn off air conditioners. Power surges from lightning can cause serious damage.
   - Use your battery operated NOAA Weather Radio for updates from local officials.
2. If **outside**, with no time to reach a safe location, follow these recommenations:
   - In a **forest**, seek shelter in a low area under a thick growth of small trees.
   - In **open areas**, go to a low place such as a ravine or valley. Be alert for flash floods.
   - Do not stand under a natural lightning rod, such as a tall, isolated tree in an open area.
   - Do not stand on a hilltop, in an open field, on the beach or in a boat on the water.
   - Avoid isolated sheds or other small structures in open areas.

- Get away from open water. If you are boating or swimming, get to land and find shelter immediately.
- Get away from anything metal—tractors, farm equipment, motorcycles, golf carts, golf clubs and bicycles.
- Stay away from wire fences, clotheslines, metal pipes, rails and other metallic paths that could carry lightning to you from some distance away.
- If you feel your hair stand on end (which indicates that lightning is about to strike), squat low to the ground on the balls of your feet. Place your hands over your ears and your head between your knees. Make yourself the smallest target possible and minimize your contact with the ground. DO NOT lie flat on the ground.

3. Remember the following facts and safety tips about lightning.

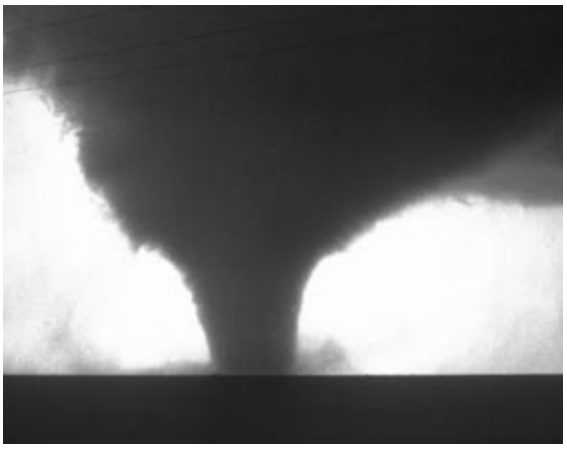
Facts:

- Lightning often strikes outside of heavy rain and may occur as far as 10 miles away from any rainfall.
- Lightning-strike victims carry no electrical charge and should be attended to immediately. If breathing has stopped, begin mouth-to-mouth resuscitation. If the heart has stopped, a trained person should administer CPR. If the victim has a pulse and is breathing, look for other possible injuries. Check for burns where the lightning entered and left the body. Be alert also for nervous system damage, broken bones, and loss of hearing or eyesight. Contact your local emergency management office or American Red Cross chapter for information on CPR and first aid classes.
- "Heat lightning" is actually lightning from a thunderstorm too far away for thunder to be heard. However, the storm may be moving in your direction!
- Most lightning deaths and injuries occur when people are caught outdoors in the summer months during the afternoon and evening.
- Many fires in the western United States and Alaska are started by lightning.
- Lightning can occur from cloud-to-cloud, within a cloud, cloud-to-ground, or cloud-to-air.
- Your chances of being struck by lightning are estimated to be 1 in 600,000 but could be even less by following safety tips.

Safety Tips:

- Postpone outdoor activities if thunderstorms are likely.
- Remember the 30/30 lightning safety rule – Go indoors if, after seeing lighting, you cannot count to 30 before hearing thunder. Stay indoors for 30 minutes after hearing the last clap of thunder.
- Rubber-soled shoes and rubber tires provide NO protection from lightning. However, the steel frame of a hard-topped vehicle provides increased protection if you are not touching metal. Although you may be injured if lightning strikes your car, you are much safer inside a vehicle than outside.

Tornadoes



Tornadoes are nature's most violent storms. Spawned from powerful thunderstorms, tornadoes can uproot trees, destroy buildings and turn harmless objects into deadly missiles. They can devastate a neighborhood in seconds.

A tornado appears as a rotating, funnel-shaped cloud that extends to the ground with whirling winds that can reach 300 miles per hour. Damage paths can be in excess of one mile wide and 50 miles long. Every state is at some risk from this hazard.

Tornado facts

1. A tornado is a violently rotating column of air extending from a thunderstorm to the ground.
2. Tornadoes are capable of destroying homes and vehicles and can cause fatalities.
3. Tornadoes may strike quickly, with little or no warning.
4. Tornadoes may appear nearly transparent until dust and debris are picked up or a cloud forms in the funnel. The average tornado moves SW to NE but tornadoes have been known to move in any direction.
5. The average forward speed is 30 mph but may vary from stationary to 70 mph with rotating winds that can reach 300 miles per hour.
6. Tornadoes can accompany tropical storms and hurricanes as they move onto land.
7. Waterspouts are tornadoes that form over water.
8. Tornadoes are most frequently reported east of the Rocky Mountains during spring and summer months but can occur in any state at any time of year.
9. In the southern states, peak tornado season is March through May, while peak months in the northern states are during the late spring and early summer.
10. Tornadoes are most likely to occur between 3 p.m. and 9 p.m., but can occur at any time of the day or night.

What to do before tornadoes threaten

1. Know the terms used to describe tornado threats:
   - **Tornado Watch**— Tornadoes are possible. Remain alert for approaching storms. Watch the sky and stay tuned to radio or television to know when warnings are issued.
   - **Tornado Warning** — A tornado has been sighted or indicated by weather radar. Take shelter immediately.
2. Ask your local emergency management office or American Red Cross chapter about the tornado threat in your area. Ask about community

warning signals.

3. Purchase a NOAA Weather Radio with a battery backup and tone-alert feature that automatically alerts you when a Watch or Warning is issued (tone alert not available in some areas). Purchase a battery-powered commercial radio and extra batteries as well.

4. Know the county or parish in which you live. Counties and parishes are used in Watches and Warnings to identify the location of tornadoes.

5. Determine places to seek shelter, such as a basement or storm cellar. If an underground shelter is not available, identify an interior room or hallway on the lowest floor.

6. Practice going to your shelter with your household.

7. Know the locations of designated shelters in places where you and your household spend time, such as public buildings, nursing homes and shopping centers. Ask local officials whether a registered engineer or architect has inspected your children's schools for shelter space.

8. Ask your local emergency manager or American Red Cross chapter if there are any public safe rooms or shelters nearby. See the "Safe Room and Shelter" section at the end of this chapter for more information.

9. Assemble a disaster supplies kit. Keep a stock of food and extra drinking water. See the "Emergency Planning and Disaster Supplies" and "Evacuation" chapters for more information.

10. Make a record of your personal property. Take photographs or videotapes of the exterior and interior of your home, including personal belongings. Store these documents in a safe place, such as a safe deposit box.

With your household, determine where you would take shelter in case a Tornado Warning was issued. Storm cellars or basements provide the best protection. If underground shelter is not available seek shelter in an interior room or hallway on the lowest floor.

What to do during a tornado watch

1. Listen to NOAA Weather Radio or to commercial radio or television newscasts for the latest information.

2. Be alert for approaching storms. If you see any revolving funnel shaped clouds, report them immediately by telephone to your local police department or sheriff's office.

3. Watch for tornado danger signs:

- Dark, often greenish sky
- Large hail
- A large, dark, low-lying cloud (particularly if rotating)
- Loud roar, similar to a freight train

Caution:

- Some tornadoes are clearly visible, while rain or nearby low-hanging clouds obscure others.
- Occasionally, tornadoes develop so rapidly that little, if any, advance warning is possible.
- Before a tornado hits, the wind may die down and the air may become very still.
- A cloud of debris can mark the location of a tornado even if a funnel is not visible.
- Tornadoes generally occur near the trailing edge of a thunderstorm. It is

not uncommon to see clear, sunlit skies behind a tornado.

4. Avoid places with wide-span roofs such as auditoriums, cafeterias, large hallways, supermarkets or shopping malls.

5. Be prepared to take shelter immediately. Gather household members and pets. Assemble supplies to take to the shelter such as flashlight, battery-powered radio, water, and first aid kit.

What to do during a tornado warning

When a tornado has been sighted, go to your shelter immediately.

1. In a residence or small building, move to a predesignated shelter, such as a basement, storm cellar or "Safe Room or Shelter."
2. If there is no basement, go to an interior room on the lower level (closets, interior hallways). Put as many walls as possible between you and the outside. Get under a sturdy table and use arms to protect head and neck. Stay there until the danger has passed.
3. Do not open windows. Use the time to seek shelter.
4. Stay away from windows, doors and outside walls. Go to the center of the room. Stay away from corners because they attract debris.
5. In a school, nursing home, hospital, factory or shopping center, go to predetermined shelter areas. Interior hallways on the lowest floor are usually safest. Stay away from windows and open spaces.
6. In a high-rise building, go to a small, interior room or hallway on the lowest floor possible.
7. Get out of vehicles, trailers and mobile homes immediately and go to the lowest floor of a sturdy nearby building or a storm shelter. Mobile homes, even if tied down, offer little protection from tornadoes.
8. If caught outside with no shelter, lie flat in a nearby ditch or depression and cover your head with your hands. Be aware of potential for flooding.
9. Do not get under an overpass or bridge. You are safer in a low, flat location.
10. Never try to outrun a tornado in urban or congested areas in a car or truck; instead, leave the vehicle immediately for safe shelter. Tornadoes are erratic and move swiftly.
11. Watch out for flying debris. Flying debris from tornadoes causes most fatalities and injuries.

If caught outside with no shelter when a tornado hits, lie flat in a nearby ditch or depression and cover your head with your hands. Be aware of potential for flooding.

What to do after a tornado

1. Look out for broken glass and downed power lines.
2. Check for injuries. Do not attempt to move seriously injured persons unless they are in immediate danger of death or further injury. If you must move an unconscious person, first stabilize the neck and back, then call for help immediately.
   - If the victim is not breathing, carefully position the victim for artificial respiration, clear the airway and commence mouth-to-mouth resuscitation.

- Maintain body temperature with blankets. Be sure the victim does not become overheated.
- Never try to feed liquids to an unconscious person.

3. Use caution when entering a damaged building. Be sure that walls, ceiling and roof are in place and that the structure rests firmly on the foundation. Wear sturdy work boots and gloves.
4. See the "Recovering From Disaster" chapter for more important information.

Wind "Safe Room and Shelter"

Extreme windstorms in many parts of the country pose a serious threat to buildings and their occupants.

Your residence may be built "to code," but that does not mean that it can withstand winds from extreme events like tornadoes or major hurricanes.

The purpose of a wind shelter or "Safe Room" is to provide a space where you and your household can seek refuge that provides a high level of protection. You can build a shelter in one of the several places in your home:

- In your basement
- Beneath a concrete slab-on-grade foundation or garage floor
- In an interior room on the first floor

Shelters built below ground level provide the greatest protection, but a shelter built in a first-floor interior room can also provide the necessary protection. Below-ground shelters must be designed to avoid accumulating water during the heavy rains that often accompany severe windstorms.

To protect its occupants, an in-house shelter must be built to withstand high winds and flying debris, even if the rest of the residence is severely damaged or destroyed. Therefore:

- The shelter must be adequately anchored to resist overturning and uplift.
- The walls, ceiling, and door of the shelter must withstand wind pressure and resist penetration by windborne objects and falling debris.
- The connections between all parts of the shelter must be strong enough to resist the wind.
- If sections of either interior or exterior residence walls are used as walls of the shelter, they must be separated from the structure of the residence, so that damage to the residence will not cause damage to the shelter.

If you are concerned about wind hazards where you live, especially if you live in high-risk areas, you should consider building a shelter. Publications are available from FEMA to assist in determining if you need a shelter and how to construct a shelter. Contact the FEMA distribution center for a copy of *Taking Shelter from the Storm* (L-233 for the brochure and FEMA-320 for the booklet with complete construction plans).